COMPACTION REPORT
KALAMA VALLEY SUBDIVISION
UNIT 6-B-1
HAWAII KAI, OAHU, HAWAII

W.O. 911-10 APRIL 8, 1983

FOR

KALAMA ASSOCIATES

C.W. ASSOCIATES INC.
DBA GEOLABS-HAWAII
2006 KALIHI STREET
HONOLULU, HAWAII 96819

CW ASSOCIATES, INC. dba
GEOLABS-HAWAII
Geology Soils and Foundation Engineering
2006 Kalihi Street • Honolulu, Hawaii 96819 • (808) 841-5064

April 8, 1983
W.O. 911-10

Gray, Hong & Associates Inc.
119 Merchant Street, Suite 607
Honolulu, Hawaii 96813

Attention: Mr. Roy Aoki

Subject: Compaction Report
Kalama Valley Subdivision
Unit 6-B-1
Hawaii Kai, Oahu, Hawaii

Reference: "Additional Soil Investigation Report
Kalama Valley Subdivision, Unit 6 - Phase II"
dated July 21, 1980

Gentlemen:

From February 18, 1981 to March 8, 1983, the earthwork and grading operations at the above referenced project were observed periodically by our firm. This report summarizes our field observations and compaction test results.

The general grading procedure consisted of cutting the eastern and western hillside slopes and filling the lower central portion of the site. In general, the expansive "adobe" clay soils were removed on side slope areas and within 3 feet of the finished grade. The expansive "adobe" clay and expansive on-site colluvium were then placed in the lower portion of the fills 3 feet below the finished

grade. The better and less expansive excavated rock material and borrow from Kamehame Ridge Subdivision were used in the upper 3 feet of fill.

Based on our observations, it is our opinion that the fills have been compacted adequately. The cut lots along the eastern and western sides of the valley generally encountered rocky material, suitable for foundation support.

Periodic field density tests were done in accordance with the American Society for Testing and Materials (ASTM) test designation D-1556 (Sand Cone Method). Since the majority of the fill material consisted of gravel and cobbles and was too large to perform compaction tests, visual observations were used to supplement the conventional compaction testing.

During the grading period, on-site and borrow soils were tested prior to being used in the field. The maximum dry densities and optimum moisture contents were established in our laboratory in accordance with ASTM test designation D-1557 (modified Proctor) and the test results are as follows:

Type of Soil	Maximum Dry Density (p.c.f.)	Optimum Moisture Content (%)
Gray Brown Clayey and Sandy Silt with gravel (borrow from Kamehame Ridge)	110.0	16.0
Gray Brown Clayey and Sandy Silt with gravel and cobbles (on-site)	110.0	17.0
Crusher Waste (import)	128.0	13.0
Gray Silt with decomposed basalt sand (on-site)	97.0	22.0

The compaction test results for the in-place fills are presented in the attached "Summary of Density Tests" and the locations of the compaction tests are shown on the Site Plan, Plate 1.

Boulder Protection

The hillside lots may be subject to boulders rolling down the hillside. This is an inherent risk for all hillside lots in any development.

The following recommendations have been presented previously to minimize the danger from boulders rolling down the hillsides:

1. Boulder sweeps along the upper boundaries of the site could be performed. However, the extent of the boulder sweep will be limited due to the steep terrain and difficult access into the areas beyond the project site.

2. The natural trees and vegetation along the upper portions of the site should be retained to act as a natural barrier against the boulders and to reduce erosion.

3. A boulder catchment area, about 10 to 15 feet wide, with a fence or wall, could be utilized near the property boundary to catch rolling boulders. The concrete interceptor ditch along the upper boundaries of the site could be used in this capacity.

4. Where practicable, the houses should be set-back away from the toe of the hillside slope to create an additional boulder catchment area.

Due to the extensive hillside area beyond the project limits, the practicality of Item No. 1 was very limited and, therefore, not utilized. Item No. 4 has limited practicability. While Items 2 and 3 were utilized instead.

Limitations

It must be pointed out that an inherent risk of falling boulders could still exist for the hillside lots.

The state of the art of soil engineering practice has not advanced to a point that a solution is available for this area. It is our opinion that, no matter what one does, there is always the risk of boulders rolling down the hill, if not from areas near the house, it will come from areas high up on the slope. Whatever measure is chosen, it only reduces the risk. It should be pointed out that no guarantee against future falling boulders can be made due to changes in soil and rock conditions with time, weathering, erosion, earthquake and construction vibration, and improvements and construction activities at and around the site.

The owners of these hillside lots should be made aware of these limitations and cautioned against future improvements in the upper areas of the lots which may disturb the stability of the existing boulders.

RECOMMENDATIONS

House foundation recommendations for Lots 17 through 51, which were based on visual observations and testing of the near surface soils, were presented in our letters of December 22, 1982 and January 17, 1983. We recommend that the soil engineer be present during the foundation construction to see that the soil conditions are consistent with our findings.

Lots 1 through 16 and 52 through 57 encountered rocky material at finished grade. The house foundations design should be evaluated on an individual lot basis when the house plans are available.

Site Grading

Subsequent to completion of lot grading, utility trenches within the lot pad should be properly backfilled and compacted under the observations of a qualified soil technician.

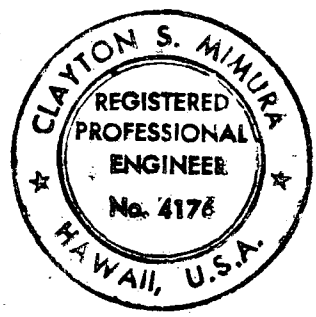
This office assumes no responsibility for any alterations made to slopes or pads on the subject lots subsequent to the final mass grading without our knowledge and written approval.

Should you have any questions concerning the above contents, please feel free to call us.

Respectfully submitted,

C.W. ASSOCIATES INC.
dba GEOLABS-HAWAII

By Clayton S. Mimura
Clayton S. Mimura, P.E.



BYKW:CSM:cw

Enclosure: Summary of Density Tests (2)
Site Plan (1)

(3 copies submitted to Addressee
1 copy to Kalama Associates)

SUMMARY OF DENSITY TESTS
CONTROL OF COMPACTED FILL

W.O. NO. 911-10
PAGE 1 OF 2

OWNER KALAMA ASSOCIATES
JOB KALAMA UNIT 6-B-1

TEST NO.	DATE	TEST LOCATION	ELEV. FT.	% COMP. REQ'D	MAX. DRY DENSITY P.C.F.	FILL MOISTURE %	TEST DRY DENSITY P.C.F.	% MAX. DRY DENSITY	REMARKS
33	9-25-81	LOT 28	147'	90	97	12.0	94.5	97.4	PASSED
34	9-28-81	" "	149'	"	97	15.0	94.2	97.0	"
35	"	" 26	150'	"	97	17.0	94.5	97.0	"
36	7-28-82	CHANNEL STA 5+50	122'	85	128	10.0	109.5	85.5	"
37	"	" STA. 6+00	127'	85	"	10.3	109.5	85.5	"
38	7-29-82	" STA. 6+50	130.5'	"	"	10.0	112.8	88.0	"
39	"	" STA. 6+50	131.5'	"	"	10.5	110.5	86.3	"
40	"	" STA. 5+75	126'	"	"	10.0	109.5	85.5	"
41	"	" STA. 6+50	132'	"	"	11.7	110.1	86.0	"
42	9-14-82	" 30	134'	90	110	22.6	87.0	79.1	FAILED
43	9-16-82	" "	"	"	"	18.3	99.2	90.2	RETEST PASSED
44	9-17-82	" 40	118'	"	"	17.8	98.9	90.0	PASSED
45	"	" 47	120'	"	"	14.6	99.7	90.6	"
46	9-21-82	" 23	177'	"	"	14.5	100.8	91.6	"
47	11-12-82	" 36	145'	"	"	15.7	89.6	81.5	FAILED
48	11-15-82	" "	"	"	"	17.7	99.6	90.5	RETEST PASSED
49	"	" 39	120'	"	"	17.9	100.0	90.9	PASSED
50	"	" 32	130'	"	"	18.4	101.2	92.0	"
51	"	" 33	137'	"	"	17.9	100.7	91.6	"
52	"	" 34	138'	"	"	16.8	101.6	92.4	"
53	"	" 35	140'	"	"	16.1	99.3	90.3	"
54	11-16-82	" 30	145'	"	"	15.9	99.0	90.0	"
55	"	" 29	145'	"	"	17.0	100.6	91.5	"

SUMMARY OF DENSITY TESTS CONTROL OF COMPACTED FILL				W.O. NO. 911-10 PAGE 2 OF 2			OWNER KALAMA ASSOCIATES JOB KALAMA UNIT 6-B-1		
TEST NO.	DATE	TEST LOCATION	ELEV. FT.	% COMP. REQ'D	MAX. DRY DENSITY P.C.F.	FILL MOISTURE %	TEST DRY DENSITY P.C.F.	% MAX. DRY DENSITY	REMARKS
56	11-16-82	LOT 37	145'	90	110	17.5	100.7	91.5	PASSED
57	"	" 38	147'	"	"	16.8	99.3	90.3	"
58	11-17-82	" 46	128'	"	"	15.1	99.5	90.5	"
59	"	" 43	134'	"	"	20.8	101.4	92.2	"
60	11-18-82	" 42	116'	"	"	18.8	99.3	90.3	"
61	"	" 45	128'	"	"	18.0	101.9	92.6	"
62	"	" 44	133'	"	"	18.1	103.0	93.7	"
63	11-19-82	" 41	119'	"	"	16.5	99.0	90.0	"
64	"	" 41	112'	"	"	15.7	100.1	91.0	"
65	12-1-82	" 49	140'	"	"	16.7	101.0	91.8	"
66	"	" 50	137'	"	"	17.1	101.7	92.5	"
67	"	" 51	141'	"	"	17.3	101.7	92.5	"
68	12-23-82	" 24	174'	"	"	14.6	105.1	95.5	"
69	"	" 25	168'	"	"	14.8	99.1	90.1	"
70	1-19-83	" 21	185'	"	"	14.0	99.2	90.2	"
71	"	" 22	182'	"	"	13.8	101.5	92.3	"
72	2-3-83	" 17	200'	"	"	13.7	99.6	90.6	"
73	"	" 18	196'	"	"	14.1	101.6	92.4	"
74	"	" 19	193'	"	"	14.3	102.6	93.2	"
75	"	" 20	188'	"	"	13.9	100.1	91.0	"
76	2-23-83	" 27	150'	"	"	17.1	100.1	91.0	"